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(54)【発明の名称】　光学補償フィルム及び液晶表示装置

(57)【要約】
【課題】　薄型軽量性と耐熱性に優れる偏光機能を有する光学補償フィルムの開発。
【解決手段】　支持フィルム（１）に位相差層（２）とコーティング膜からなる偏光層（３）を少なくとも密着付設してなる光学補償フィルム及びその光学補償フィルムを有する液晶表示装置。
【効果】　支持フィルムにコーティング方式にて薄さと耐熱性に優れる偏光層を付与できて効率よく製造でき、良視認の視野角に優れる液晶セルを形成できる。

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【特許請求の範囲】

【請求項１】　支持フィルムに位相差層とコーティング膜からなる偏光層を少なくとも密着付設してなることを特徴とする光学補償フィルム。

【請求項２】　請求項１において、位相差層が液晶ポリマー層からなる光学補償フィルム。

【請求項３】　請求項１又は２において、偏光層がリオトロピック液晶性の二色性色素、二色性染料含有の液晶ポリマー層又は二色性染料含有のリオトロピック性物質からなる光学補償フィルム。

【請求項４】　請求項１～３において、支持フィルムの片面に位相差層を、他面に偏光層を有する光学補償フィルム。

【請求項５】　請求項１～４において、偏光層が厚さ５μm以下で、その表面に保護層を有する光学補償フィルム。

【請求項６】　請求項１～５に記載の光学補償フィルムを有することを特徴とする液晶表示装置。

【発明の詳細な説明】

【０００１】

【発明の技術分野】本発明は、耐熱性や薄型軽量性等に優れて良視認の視野角に優れる液晶表示装置を形成しうる偏光機能を有する光学補償フィルムに関する。

【０００２】

【従来の技術】従来、偏光機能を有する光学補償フィルムとしては、透明フィルムにディスコティック系やネマチック系の液晶ポリマーの傾斜配向層を設けた位相差層（特開平６－２１４１６号公報）と偏光フィルム系の偏光板とを接着積層したものが知られていた。しかしながらその偏光板が偏光フィルムの両面に接着層を介し透明保護フィルムを付設してなる五層構造を有して通例１００μm以上の総厚であるため軽量薄型性に乏しく、また偏光フィルムの耐熱性不足で８０℃以上での使用が困難な問題点があった。

【０００３】

【発明の技術的課題】本発明は、薄型軽量性と耐熱性に優れる偏光機能を有する光学補償フィルムの開発を課題とする。

【０００４】

【課題の解決手段】本発明は、支持フィルムに位相差層とコーティング膜からなる偏光層を少なくとも密着付設してなることを特徴とする光学補償フィルム、及びその光学補償フィルムを有することを特徴とする液晶表示装置を提供するものである。

【０００５】

【発明の効果】本発明によれば、支持フィルムにコーティング方式にて薄さと耐熱性に優れる偏光層を付与できて効率よく製造でき、薄型軽量性と耐熱性に優れる光学補償フィルムを得ることができ、それを用いて良視認の視野角に優れる液晶表示装置を形成することができる。

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【０００６】

【発明の実施形態】本発明による光学補償フィルムは、支持フィルムに位相差層とコーティング膜からなる偏光層を少なくとも密着付設したものからなる。その例を図１、図２、図３に示した。１が支持フィルム、２が位相差層、３が偏光層であり、４は必要に応じての保護層である。図例の如く光学補償フィルムは、支持フィルム１の片面に位相差層２、他面に偏光層３を有する形態や、支持フィルム１の同じ側に位相差層２と偏光層３を有する形態などの適宜な層形態にて形成することができる。

【０００７】支持フィルムについては、特に限定はなく適宜な透明ポリマーからなるフィルムを用いる。就中、透明性や機械的強度、熱安定性や水分遮蔽性等に優れると共に、厚さの均一性に優れて位相差の可及的に小さいものが好ましく用いうる。ちなみに前記ポリマーの例としては、三酢酸セルロースの如きセルロース系樹脂やポリエステル、ポリカーボネートやポリアミド、ポリイミドやポリエーテルスルホン、ポリスルホンやポリスチレン、アクリル系樹脂やポリオレフィン、ノルボルネン系樹脂などがあげられる。支持フィルムの厚さは、強度等に応じて適宜に決定しうるが、一般には軽量化等を目的に５００μm以下、就中５～３００μm、特に１０～２００μmとされる。

【０００８】支持フィルムに密着付設する位相差層は、液晶セルの複屈折による位相差を補償してその位相差に基づく視角変化による着色等を防止したり良視認の視野角を拡大したりすることなどを目的とするものであり、その目的に応じた例えば延伸フィルム層や液晶ポリマーの配向層等の適宜な複屈折性の位相差層にて形成することができる。ちなみに視野角の拡大にはディスコティック系やネマチック系の液晶ポリマーの傾斜配向層などが有利に用いうる。

【０００９】支持フィルムによる位相差層の密着支持は、例えば必要に応じ接着剤層を介したフィルムの接着方式やポリマー液のコーティング方式などの適宜な方式にて行うことができ、液晶ポリマーの配向処理に際しては必要に応じてラビング処理層等の配向膜を介在させることができる。位相差層の厚さは、目的とする位相差等に応じて適宜に決定しうるが、一般には３００μm以下、就中０．１～１００μm、特に０．５～５０μmとされる。

【００１０】支持フィルムに密着付設する偏光層は、光学補償フィルムに偏光機能を付与することを目的とし、本発明にては可及的に層厚の薄い偏光層とするために例えばキャスティング方式やスピンコート方式等の適宜な塗工方式によるコーティング膜として形成される。光学補償フィルムの薄型化の点より偏光層の好ましい厚さは、偏光特性や耐久性等も考慮して１５μm以下、就中０．１～５μm、特に０．２～３μmである。

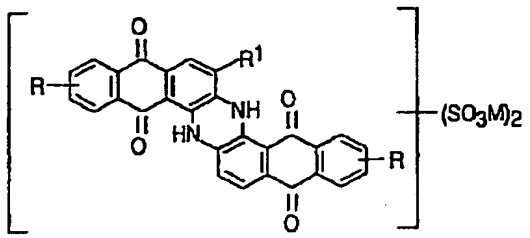
【００１１】従って偏光層の形成にはコーティング方式

にて形成しうる適宜な材料を用いることができ、特に限定はない。就中、耐熱性等に優れる偏光層を得る点などよりは、リオトロピック液晶性の二色性色素や二色性染料含有の液晶ポリマー、二色性染料含有のリオトロピック性物質（例えばＯｐｔｉｖａ社製、ＬＣポラライザー等）などが好ましく用いうる（ＷＯ９７／３９３８０号公報）。

【００１２】ちなみに前記したリオトロピック液晶性の二色性色素としては、例えば式：（クロモゲン）（ＳＯ３Ｍ）ｎで表される水溶性の有機色素などがあげられ、これはクロモゲンがアゾや多環式化合物等からなって液晶性を付与し、スルホン酸又はその塩が水溶性を付与して全体としてリオトロピック液晶性を示す（特表平８－５１１１０９号公報）。

【００１３】なお前記した二色性色素の具体例としては、下記の式（１）～（７）で表される化合物などがあげられる。

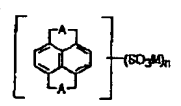
(1):



【００１４】前記の式（１）において、Ｒ１は水素又は塩素であり、Ｒは水素、アルキル基、ＡｒＮＨ又はＡｒＣＯＮＨである。アルキル基としては炭素数が１～４個のもの、就中メチル基やエチル基が好ましく、アリール基（Ａｒ）としては置換又は無置換のフェニル基、就中４位を塩素で置換したフェニル基が好ましい。またＭはカチオンであり、水素イオン、ＬｉやＮａ、ＫやＣｓの如き第一族金属のイオン、アンモニウムイオンなどが好ましい（以下同じ）。

【００１５】

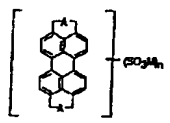
(2):



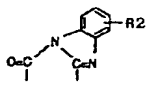
A:

a)

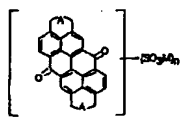
(3):



b)



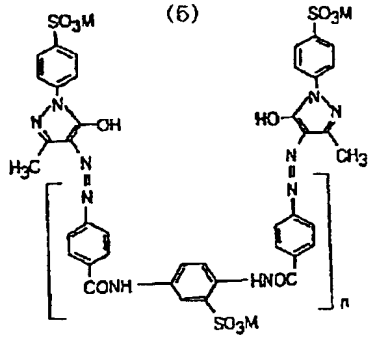
(4):



【００１６】前記式（２）～（４）において、Ａは式（ａ）又は（ｂ）で表されるものあり、そのＲ２は水素、アルキル基、ハロゲン又はアルコキシ基、Ａｒは置換又は無置換のアリール基、ｎは２又は３である。前記のアルキル基は炭素数が１～４個のもの、就中メチル基又はエチル基が好ましく、ハロゲンは臭素又は塩素が好ましい。またアルコキシ基は炭素数が１又は２個のもの、就中メトキシ基が好ましく、アリール基は置換又は無置換のフェニル基、就中、無置換あるいは４位をメトキシ基、エトキシ基、塩素若しくはブチル基で、又は３位をメチル基で置換したフェニル基が好ましい。

【００１７】

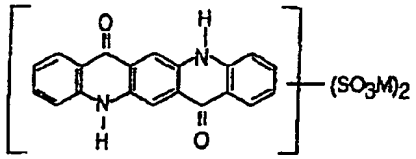
(5)



【００１８】前記の式（５）において、ｎは３～５が好ましい。

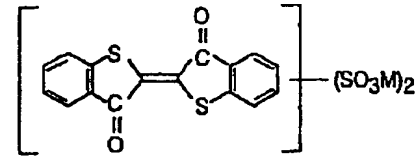
【００１９】

(6):



【００２０】

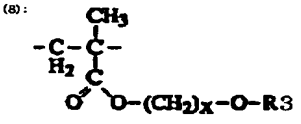
(7):



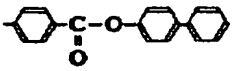
【００２１】上記の式：（クロモゲン）（ＳＯ３Ｍ）ｎで表される有機色素は、そのクロモゲンにて安定な液晶相を示し、水やアセトン、アルコール、ジオキサンの如き水溶性有機溶媒に溶解し、その色素の１種又は２種以上を溶解させた例えば固形分濃度が１～２０重量％の溶液をドクターブレード方式等の剪断力が作用する適宜な塗工方式で塗工することで配向処理でき、その配向固化層が二色性の偏光機能を示す。

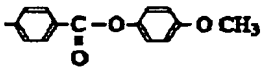
【００２２】一方、上記した二色性染料を含有して偏光機能を示す液晶ポリマーとしては、一軸配向性を示す適宜なものを用いうる。ちなみにその例としては、下記の式（８）で表されるものなどがあげられる（特開平１１－１０１９６４号公報）。

(8):



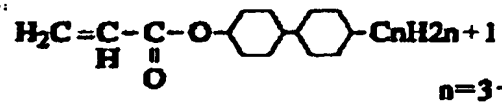
X:2~8

R3 : 

Xは、 

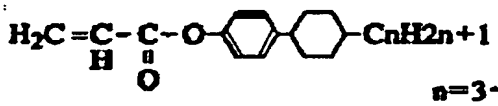
【００２３】また液晶ポリマーは、下記の式（イ）～（ニ）で表される液晶モノマーの１種又は２種以上を用＊いて紫外線照射により重合処理したものであってもよい（特開平１１－１０１９６４号公報）。

(イ):



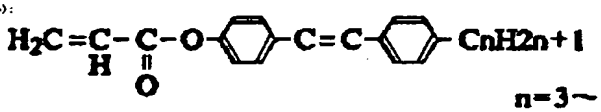
n=3~8

(ロ):



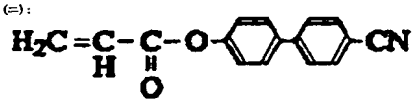
n=3~8

(ハ):



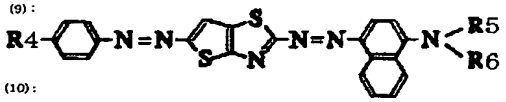
n=3~8

(ニ):

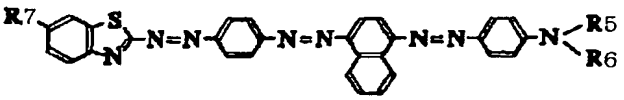


【００２４】他方、液晶ポリマー層に含有させる二色性染料としても適宜なものを用いることができ、特に限定はない。耐熱性等に優れる偏光層を得る点よりは下記の式（９）～（１１）で表されるものなどが好ましく用いうる（特開平１１－１０１９６４号公報）。

(9):

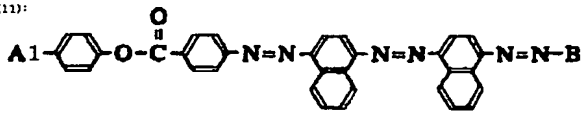


(10):

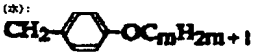


【００２５】

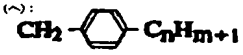
(11):



(ホ):



(ヘ):

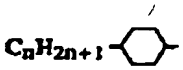


(ト):

【００２６】前記の式（９）、（１０）において、Ｒ４は水素、ハロゲン、C_nH_{2n+1}、COC_nH_{2n+1}、$OCOC_nH_{2n+1}$、$COOC_nH_{2n+1}$又は$CH_2COOC_nH_{2n+1}$である。またＲ５、Ｒ６は、水素又はC_nH_{2n+1}であり、かつＲ６は下記の式（ホ）又は（ヘ）で表されるものであってもよい。さらにＲ５とＲ６はそれらで下記の式（ト）で表されるものであってもよい。一方、Ｒ７は水素、ハロゲン又はC_nH_{2n+1}である。なおｎは１～８で、ｍは１～５である。

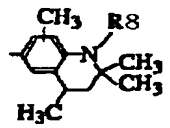
【００２７】

【００２８】他方、式（１１）において、Ａ１はC_nH_{2n+1}又は下記のものであり、そのｎは１～８である。



【００２９】また式（１１）におけるＢは、下記の式（チ）～（ル）で表されるものであり、Ｒ８はC_nH_{2n+1}又は$C_nH_{2n}OCH_3$で、そのｎは１～８である。

(チ):



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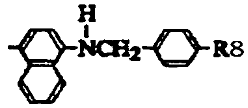

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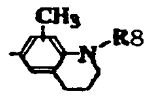

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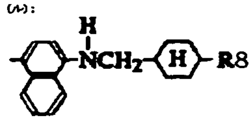
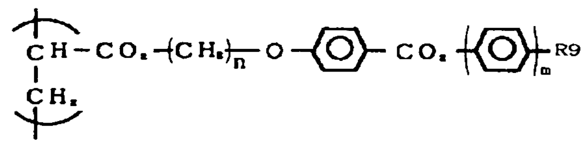


【0030】前記において偏光層の形成は、例えば１種又は２種以上の液晶ポリマーを含有する溶液に二色性染料を配合し、それを配向膜等の上に塗工して液晶ポリマーを一軸配向させる方式などにより行うことができる。＊液晶ポリマーの溶液化には通例、溶剤を用いて固形分濃度１～２０重量％程度のものとされるが、液晶モノマーを紫外線で重合する場合には溶剤の使用を回避することもできる。また二色性染料は、偏光特性の波長域などに応じて１種又は２種以上を用いることができ、その使用量は液晶ポリマー又は液晶モノマーの１～２０重量％が一般的である。

【0031】上記した二色性染料を含有して偏光機能を示す液晶ポリマーの例としては、下記の式（１２）で表されるものなどもあげられる（日東技報Ｖｏｌ３５，Ｎｏ．１（１９９７），ｐ７９－８２）。

(12):



なお式中のｎは１～１０、Ｒ９はシアノ基又はメトキシ基等のアルコキシ基、ｍは１～５である。

【0032】図２に例示の如く偏光層３の上に必要に応じて設ける保護層４は、視認を阻害する擦り傷の発生防止などを目的とする。従って保護層は、光学補償機能を阻害しない上記の支持フィルムで例示したポリマーなどの適宜な物質にて形成することができる。就中、例えば多官能性単量体を光触媒等を介して紫外線照射により三次元架橋しうるようにした例えばウレタンアクリル系やエポキシ系等の紫外線硬化樹脂などの透明な硬質膜を形成する適宜な架橋性樹脂が好ましく用いうる。

【0033】保護層の形成は、フィルムの接着方式などにても形成しうるが、薄層化等の点よりは例えばキャスティング方式やスピンコート方式やディッピング方式等の適宜な塗工方式でポリマー液ないし樹脂液を所定面上に展開して必要に応じ架橋処理する方法などにより行うことができる。保護層の厚さは、適宜に決定でき一般には２００μｍ以下、就中１００μｍ以下、特に１～５０μｍとされる。なお図３に例示の如く位相差層２の上に偏光層３を設ける場合にも位相差層の変質を防止する点などより前記に準じた保護層４を介する方式にて行うことが好ましい。偏光層の上に位相差層を設ける場合も同様である。

【0034】本発明による光学補償フィルムは、液晶表示装置の形成などに好ましく用いうる。その場合、位相差層と偏光層とが予め積層一体化されていることより光軸のズレ等による品質のバラツキが生じにくく、液晶表示装置の組立効率に優れるなどの利点を有している。液晶表示装置の形成に際しては液晶セルの片側又は両側に光学補償フィルムを配置しうる。その場合、位相差層又は偏光層のいずれを液晶セル側としてもよいが、補償効果等の点よりは偏光層と液晶セルの間に位相差層が位置する配置構造が通例の場合、好ましい。なお適用する液晶セルは、例えばＴＮ型やＳＴＮ型、ＴＦＴ型や強誘電性液晶型など任意である。

【0035】

【実施例】実施例１

三酢酸セルロースフィルムの片面に傾斜配向の液晶ポリマー層を設けてなる位相差板（富士フイルム社製、ＷＶフィルム）の前記フィルムの露出面に、二色性染料含有のリオトロピック液晶水溶液（Ｏｐｔｉｖａ社製、ＬＣポラライザー、固形分濃度８．７重量％）をワイヤバー（Ｎｏ．７）にてコーティング後、８０℃で乾燥させて厚さ１．３μｍの偏光層を形成して、光学補償フィルムを得た。

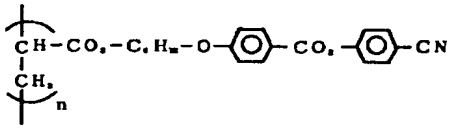
【0036】前記の光学補償フィルムは、総厚が１１０μｍであり、波長４００～７００nmの波長域における光透過率は４０％で、その偏光度は９０％であり、それを９０℃、５００時間の耐久試験に供したところ、光学特性に変化はなく、また補償フィルムの変形等も生じなかった。

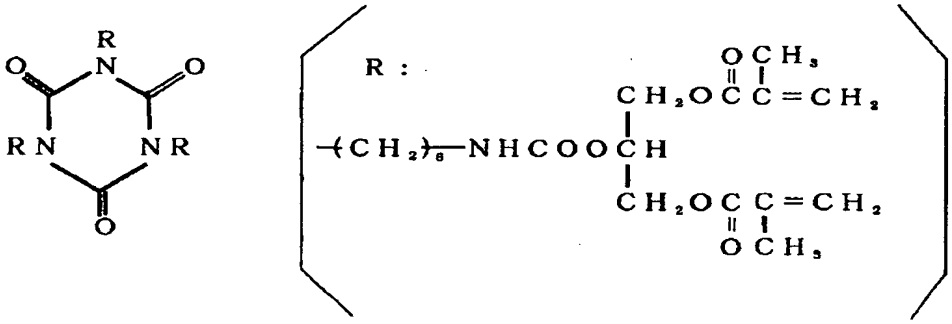
【0037】実施例２

ＷＶフィルムの三酢酸セルロースフィルム露出面にポリビニルアルコールをスピンコートしてその表面をレーヨン布でラビング処理した後、その上に二色性染料含有の液晶ポリマー溶液をスピンコートし、１００℃で加熱配向処理して厚さ１．５μｍの偏光層を形成し、ついでその上にウレタンアクリル系樹脂からなる厚さ５μｍの保護層を形成たほかは、実施例１に準じて光学補償フィルムを得た。この光学補償フィルムは、総厚が１１０μｍであり、波長４００～７００nmの波長域における光透過率は３８％で、その偏光度は８８％であり、それを９０℃、５００時間の耐久試験に供したところ、光学特性に変化はなく、また補償フィルムの変形等も生じなかっ

た。

【００３８】なお前記の液晶ポリマー溶液は、下式で表される側鎖型液晶ポリマー２６部、Ｇ－２０２染料０．３７部（日本感光色素社製、以下同じ）、Ｇ－２０７染料０．７３部及びＧ－４２９染料１．４６部をテトラクロロエタン１００部にて均一に混合したものである。





【００３９】また前記の保護層は、下式で表されるウレタンアクリル系樹脂を塗布し、紫外線を照射して厚さ５μmの架橋層を形成したものである。

【００４０】比較例

偏光層に代えて、厚さ２１５μmの偏光板（日東電工社製、ＮＰＦ－Ｇ１２２５ＤＵＮ）を厚さ２５μmのアクリル系粘着層を介し接着積層したほかは、実施例１に準じて光学補償フィルムを得た。この光学補償フィルムは、総厚が３４９μmであり、波長４００～７００nmの波長域における光透過率は３８％で、その偏光度は９９％であったが、それを９０℃、５００時間の耐久試験に供すると光学特性が低下すると共に、補償フィルムが極端にカールした状態となって実用に供せないものとなった。

【００４１】実施例２，比較例で得た光学補償フィルムを厚さ２５μmのアクリル系粘着層を介しＴＮ型液晶セルに接着して９０℃、２４０時間の耐久試験に供したところ、実施例２では点灯による表示状態に変化は認められなかったが、比較例では光学歪みによる枠状のムラが観察された。

【図面の簡単な説明】

【図１】光学補償フィルム例の断面図

【図２】他の光学補償フィルム例の断面図

【図３】さらに他の光学補償フィルム例の断面図

【符号の説明】

１：支持フィルム

２：位相差層

３：偏光層

４：保護層

【図１】

【図２】

【図３】

フロントページの続き

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(72)Inventor : KITAGAWA ATSUSHI
OTANI AKIRA

(54) TITLE OF THE INVENTION

OPTICAL COMPENSATION FILM AND LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain an optical compensation film which is superior in thinness, lightness and heat resistance and having polarizing function.

SOLUTION: A phase difference layer 2 and a polarizing layer 3 consisting of a coating film are at least adhered to a base film 1, to efficiently manufacture the optical compensation film and a liquid

crystal cell superior in visibility and a visual field angle can be formed. A liquid crystal display has the optical compensation film.

[Claims]

[Claim 1] An optical compensation film comprising at least a laminate having a phase difference layer and a polarizing layer consisting of a coating film are formed on a support film.

[Claim 2] An optical compensation film according to Claim 1, wherein said phase difference layer is made of a liquid-crystal polymer layer.

[Claim 3] An optical compensation film according to Claim 1 or 2, wherein said polarizing layer is made of one member selected from the group consisting of a Lyotropic liquid-crystal dichromatic dye, a dichromatic dye-containing liquid-crystal polymer layer, or a dichromatic dye-containing lyotropic substance.

[Claim 4] An optical compensation film according to Claims 1 to 3, wherein a support film has said phase difference layer on one side and has said polarizing layer on the other side.

[Claim 5] An optical compensation film according to Claims 1 to 4, wherein said polarizing layer has a thickness of not larger than 5 μm, and has a protective layer on the surface.

[Claim 6] A liquid-crystal display apparatus characterized by comprising an optical compensation film according to Claim 1 to 5.

[DEATILED DESCRUPTION OF THE INVENTION]

[0001]

[Field of the Invention]

The present invention relate to an optical compensation film which has a polarizing function capable of forming a liquid-crystal display apparatus, and which is excellent in heat resistance, in reduction in thickness and weight and is also excellent in viewing angle of good recognition.

[0002]

[Description of the Prior Art]

There has been heretofore known an optical compensation film having a polarization function, which has been obtained in such a manner that a phase difference layer provided with an obliquely oriented layer of a discotic or nematic type liquid-crystal polymer on a transparent film (Japanese Patent Publication No. 6-21416), and a polarizing plate of a polarizing film type have been adhesively laminated. However, since the polarizing plate has been a 5-layer structure provided with transparent protective films on both sides of a polarizing film through adhesive layers and a total thickness thereof has generally been 100 μm or more, there have been problems that reduction in thickness and weight has been insufficient, and use of a polarizing film has been difficult at 80℃ or more, because heat resistance thereof has been insufficient.

[0003]

[SUMMARY OF THE INVENTION]

An object of the present invention is to develop an optical compensation film having a polarizing function, which is excellent in reduction in thickness and weight and in heat resistance.

[0004]

[MEANS FOR SOLVING THE PROBLEMS]

The present invention provides an optical compensation film formed of at least a laminate having a phase difference layer and a polarizing layer consisting of a coating film on a support film, and a liquid-crystal display apparatus comprising the optical compensation film.

[0005]

[EFFECT OF THE INVENTION]

According to the present invention, a polarizing layer which is excellent in reduction in thickness and heat resistance can be provided to a support film with a coating method to produce efficiently, and an optical compensation film which is excellent in reduction in thickness and weight, and in heat resistance can be obtained, so that it is possible to form a liquid-crystal display apparatus which is excellent in viewing angle of good recognition by using it.

[0006]

[Embodiments of the Invention]

An optical compensation film according to the present invention is formed of at least a laminate comprising a phase difference layer and a polarizing layer consisting of a coating film on a support film. The examples are shown in Figs. 1 to 3. Reference numeral 1 represents a support film; 2, a phase difference layer; 3, a polarization layer; and 4, a protective layer provided as occasion demands. As shown in the drawings, the optical compensation film can be formed with suitable layer configurations such as a configuration that the support film 1 has the phase difference layer 2 on one side and the polarizing layer 3 on the other side, a configuration that the support film 1 has the phase difference layer 2 and the polarizing layer 3 on the same side, or the like.

[0007]

A film made of a suitable transparent polymer film can be used as the support film without any particular limitation. Especially, there can be preferably used a film which is excellent in transparency, mechanical strength, thermal stability, and moisture sealability, and is excellent in uniformity of thickness so that the phase difference is as small as possible. Incidentally, examples of said polymer includes; a cellulose-based resin such as cellulose triacetate; a polyester-based resin, a polycarbonate-based resin, a polyamide, a polyimide-based resin, a polyethersulfone-based resin, a polysulfone-based resin, a polystyrene-based resin,

an acrylic-based resin, a polyolefine-based resin, a norbornene-based resin, or the like. The thickness of the support film can be suitably determined for the purpose of the strength or the like, and from the point of view of reduction in weight or the like, is set to be not larger than 500 μm, especially in a range of from 5 to 300 μm, further especially in a range of from 10 to 200 μm.

[0008]

The phase difference layer which is adhesively laminated to the support film aims to compensate a phase difference caused by birefringence of a liquid-crystal cell, and prevent coloring or the like caused by visual angle change based on the phase difference, and widening a viewing angle with good visibility; and can be formed with a phase difference layer having suitable birefringence property, such as a stretched film layer, an obliquely orientated liquid-crystal polymer layer or the like in accordance with that purpose. Incidentally, an obliquely oriented layer of a discotic or nematic type liquid-crystal polymer may be advantageously used for widening the viewing angle.

[0009]

To adhesively support the phase difference layer by the support film can be performed a suitable method, for example a film laminating method through an adhesives layer used as needed, a coating method of polymer liquid, or the like; when

performing an orienting process of the liquid-crystal polymer, an orientation film, such as a rubbing processing layer, may be involved as needed. A thickness of the phase difference layer can be suitably determined according to the phase difference or the like, and at typically at most 300 μm, preferably from 0.1 to 100 μm, more preferably from 0.5 to 50 μm.

[0010]

The polarizing layer which is adhesively laminated to the support film aims to provide a polarizing function to the optical compensation film; and in the present invention, in order to make a polarizing layer having a layer thickness as thin as possible, is formed as a coating film coated by a suitable coating method, such as a casting method, a spin coating method or the like. From a point of view of reduction in thickness of the optical compensation film, the thickness of the polarization layer, taking polarizing characteristic, durability or the like into account, is not larger than 15 μm, especially in a range of from 0.1 to 5 μm, further especially in a range of from 0.2 to 3 μm.

[0011]

Thus, a suitable material can be used for forming the polarizing layer by the coating method without any particular limitation. Especially, from a point of view of obtaining a polarizing layer which is excellent in heat resistance or the

like, a lyotropic liquid-crystal dichromatic dye, a dichromatic dye-containing liquid-crystal polymer, a dichromatic dye-containing lyotropic substance, or the like (for example, tradename LC Polarizer, made by Optiva Inc.) are preferably used (PCT Publication WO97/39380).

[0012]

Incidentally, a water-soluble organic dye, for example, represented by the formula: (chromogen) $(SO_3M)_n$, can be used as the lyotropic liquid-crystal dichromatic dye, wherein chromogen is made of an azo or polycyclic compound or the like and gives mesomorphism, and sulfonic acid or its salt gives water-solubility, and the water-soluble organic dye exhibits lyotropic mesomorphism as a whole (Japanese Patent Publication No. 8-511109).

[0013]

Incidentally, specific examples of the dichromatic dye include compounds represented by the following formulae (1) to (7).

[Chemical formula 1]

[0014]

In the formula (1), R1 is hydrogen or chlorine, and R is hydrogen, alkyl radical, ArNH or ArCONH. The alkyl radical preferably has 1 to 4 carbon atoms, especially, methyl radial or ethyl radical is preferably used as the alkyl radial, and substituted or non-substituted phenyl radical is preferably

used as the aryl radical (Ar), especially, phenyl radical having the fourth position replaced by chlorine is preferably used as the aryl radical (Ar). Further, M is cation, hydrogen ion, ion of Group I metal such as Li, Na, K or Cs, ammonium ion or the like is preferably used as the cation (this rule applies hereunder).

[0015]

[Chemical formula 2]

[Chemical formula 3]

[Chemical formula 4]

[0016]

In said formulae (2) to (4), A is represented by the formula (a) or (b) in which R2 is hydrogen, alkyl radical, halogen or alkoxy radical, Ar is substituted or non-substituted aryl radial, and n is equal to 2 or 3. Said alkyl radial preferably has 1 to 4 carbon atoms, especially, methyl radical or ethyl radical is preferably used as the alkyl radical, and bromine or chlorine is preferably used as the halogen. Further, alkoxy radical preferably has 1 or 2 carbon atoms, especially, methoxy radical is preferably used as the alkoxy radical, and substituted or non-substituted phenyl radical is preferably used as the aryl radical, especially, non-substituted phenyl radical or phenyl radical having the fourth position replaced by methoxy radical, ethoxy radical, chlorine or butyl radical and the third position replaced by methyl radical is preferably

used as the aryl radical.

[0017]

[Chemical formula 5]

[0018]

In the formula (5), n is preferably an integer of from 3 to 5.

[0019]

[Chemical formula 6]

[0020]

[Chemical formula 7]

[0021]

The organic dye represented by above formula: (chromogen) $(SO_3M)_n$ exhibits a stable liquid-crystal phase based on the chromogen, is soluble in water or in a water-soluble organic solvent such as acetone, alcohol, or dioxane; and when, for example, a solution of solids concentration of 1 to 20% by weight of at least one kind of dye obtained in such a manner is applied by a suitable coating method using the action of shearing force such as a doctor blade method, an orienting process can be performed, and the oriented solidified layer obtained thus exhibits a dichromatic polarizing function.

[0022]

On the other hand, a suitable polymer exhibiting uniaxial orienting characteristic can be used as the liquid-crystal polymer containing the dichromatic dye and exhibiting a

polarizing function. Incidentally, for example, the polymer maybe represented by the following formula (8) (Japanese Patent Publication No. 11-101964).

[Chemical formula 8]

[0023]

The liquid-crystal polymer may be obtained by polymerization of at least one of liquid-crystal monomers represented by the following formulae (a) to (d) on the basis of irradiation with ultraviolet rays (Japanese Patent Publication No. 11-101964).

[Chemical formula a]

[Chemical formula b]

[Chemical formula c]

[Chemical formula d]

[0024]

On the other hand, a suitable dye can be used as the dichromatic dye to be contained in the liquid-crystal polymer layer without any particular limitation. From the point of view to obtain a polarizing layer excellent in heat resistance, dyes represented by the following formulae (9) to (11) may be preferably used (Japanese Patent Publication No. 11-101964).

[Chemical formula 9]

[Chemical formula 10] [0025]

[Chemical formula 11]

[0026]

In the formulae (9) and (10), R4 is hydrogen, halogen, C_nH_{2n+1}, COC_nH_{2n+1}, $OCOC_nH_{2n+1}$, $COOC_nH_{2n+1}$ or $CH_2COOC_nH_{2n+1}$. Further, each of R5 and R6 is hydrogen or C_nH_{2n+1}, and R6 may be one of radicals represented by the following formulae (e) or (f). Further, each of R5 and R6 may be represented by the following formula (g). On the other hand, R7 is hydrogen, halogen, or C_nH_{2n+1}. Incidentally, n is an integer of from 1 to 8, and m is an integer of from 1 to 5.

[0027]

[Chemical formula e]

[Chemical formula f]

[Chemical formula g]

[0028]

On the other hand, in the formula (11), Al is C_nH_{2n+1} or a radical represented by the following formula in which n is an integer of from 1 to 8.

[Chemical formula 0028]

[0029]

Further, in the formula (11), B is one of radicals represented by the following formulae (h) to (k) in which R8 is C_nH_{2n+1} or $C_nH_{2n}OCH_3$ in which n is an integer of from 1 to 8.

[Chemical formula h]

[Chemical formula i]

[Chemical formula j]

[Chemical formula k]

[0030]

In the above description, the formation of the polarizing layer can be performed in such a method, for example that a dichromatic dye is mixed with a solution containing at least one kind of liquid-crystal polymer and the mixture solution is applied on an oriented film to thereby orient the liquid-crystal polymer uniaxially. A solvent is generally used for dissolving the liquid-crystal polymer to set the solids concentration of the liquid-crystal polymer to be in a range of from 1 to 20% by weight; and however when liquid-crystal monomer is polymerized by ultraviolet rays, the use of such a solvent may be avoided. Further, as the dichromatic dye, at least one kind of dichromatic dye can be used in accordance with the wavelength region of polarizing characteristic, and the amount of use of the dichromatic dye is generally in a range of from 1 to 20% by weight with respect to the weight of the liquid-crystal polymer or monomer.

[0031]

An example of the liquid-crystal polymer containing the dichromatic dye and exhibiting a polarizing function is represented by the formula (12) (Nitto Technical Report Vol.35, No.1 (1997), pp79-82).

[Chemical formula 12]

Incidentally, in the formula, n is an integer of from 1 to 10, R9 is an alkoxy radical such as a cyano radical or a methoxy

radical, and m is an integer of from 1 to 5.

[0032]

As shown in Fig. 2, the protective layer 4 provided as needed on the polarizing layer 3 aims to prevent mar which disturbs viewing. Therefore, the protective layer can be formed by a suitable material such as polymers which is illustrated in the description for the support film, and which does not disturb an optical compensation function. Especially, there can be preferably used a suitable crosslinkable resin which contains multifunctional monomer capable of being crosslinked three-dimensionally by irradiation with ultraviolet rays through a photocatalyst to thereby form a transparent hard film of an ultraviolet-curable resin such as an urethane-acrylic resin or an epoxy resin.

[0033]

Formation of the protective layer can be formed by a film laminating method or the like, however from a point of view of reduction in thickness, it can be formed in such a method that a polymer liquid or a resin liquid is spread on a predetermined surface by a suitable coating method such as a casting method, a spin coating method, a dipping method, or the like for example, and then a crosslinking process is performed, as occasion demands. The thickness of the protective layer can be determined suitably and is generally set to be not larger than 200 μm, especially not larger than 100 μm, and further

especially in a range of from 1 to 50 μm. Incidentally, as shown in Fig. 3, also when the polarizing layer 3 is formed on the phase difference layer 2, from a point of view of preventing deterioration of the phase difference layer or the like, it is preferable to form polarizing layer using a method through the protective layer 4 based on the above description. Similarly, the phase difference layer may also be formed on the polarizing layer.

[0034]

The optical compensation film according to the present invention can be preferably used for the formation of a liquid-crystal display apparatus, or the like. In that case, the phase difference layer and the polarizing layer are integrally laminated on each other in advance; and hence, there is an advantage that variation in quality owing to displacement of the optical axis is hardly generated so that efficiency in assembling the liquid-crystal display apparatus is excellent. For the formation of the liquid-crystal display apparatus, the optical compensation film may be disposed on one side or both sides of opposite surfaces of the liquid-crystal cell. In this case, either of the phase difference layer and the polarizing layer may be provided on the liquid-crystal display cell side, an arrangement structure in which the phase difference layer is located between the polarizing layer and the liquid-crystal cell is generally preferred from the point of view of the

compensating effect or the like. Incidentally, the liquid-crystal cell applied is optionally selected from a TN type cell, an STN type cell, a TFT type cell, a ferroelectric liquid-crystal type cell, and so on.

[0035]

[EXAMPLE]

EXAMPLE 1

An exposed surface of a triacetic acid cellulose film of a phase difference plate (WV film made by Fuji Photo Film Co., Ltd.) provided with an obliquely oriented liquid-crystal polymer layer on one side of said triacetic acid cellulose film was coated with a dichromatic dye-containing lyotropic liquid-crystal aqueous solution (LC Polarizer with a solids concentration of 8.7% by weight, made by Optiva Corp.) by wire bar (No.7), then the solution was dried at 80℃ to form a 1.3 μm-thick polarizing layer; and thus, an optical compensation film was obtained.

[0036]

Said optical compensation film had a total thickness of 110 μm, a light transmittance of 40% in a wavelength range of from 400 to 700 nm, and a polarization degree of 90%; and when a durability test was performed thereon at 90℃, for 500 hours, any changes in optical properties were not found, and deformation or the like of the compensation film was not caused either.

[0037]

EXAMPLE 2

An optical compensation film was obtained in a same manner as EXAMPLE 1 except that an exposed surface of a triacetic acid cellulose film of the WV film was spin-coated with a polyvinyl alcohol and a rubbing processing was performed on the surface with a rayon cloth, then a dichromatic dye-containing liquid-crystal polymer solution was spin-coated thereon, the solution was heated at 100℃ and oriented to form a 1.5 μm-thick polarizing layer, subsequently, a 5 μm-thick protective layer consisting of a urethane-acrylic resin was formed thereon. This optical compensation film had a total thickness of 110 μm, a light transmittance of 38% in a wavelength range of from 400 to 700 nm, and a polarization degree of 88%; and when a durability test was performed thereon at 90℃, for 500 hours, any changes in optical properties were not found, and deformation or the like of the compensation film was not caused either.

[0038]

Incidentally, said liquid-crystal polymer solution contains 26% by weight of side-chain liquid-crystal polymer represented by the following formula 0.37% by weight of G-202 dye (made by Nippon Kannko Sikiso Co., Ltd., the followings are the same) 0.73% by weight of G-207 dye and 1.46% by weight of G-429 dye which are uniformly mixed by 100% by weight of

tetrachloroethane.

[Chemical formula 0038]

[0039]

Further, a urethane-acrylic resin represented by the following formula was coated, then ultraviolet rays were irradiated thereon to form a 5 μm-thick crosslinking layer, so that said protective layer was obtained.

[Chemical formula 0039]

[0040]

COMPARATIVE EXAMPLE

An optical compensation film was obtained in a same manner as EXAMPLE 1 except that instead of the polarizing layer, a 215 μm-thick polarizing plate (NPF-G1225DUN made by Nitto Denko Corp.) was adhesively laminated through a 25 μm-thick acrylic adhesive layer. This optical compensation film had a total thickness of 349 μm, a light transmittance of 38% in a wavelength range of from 400 to 700 nm, and a polarization degree of 99%; and when a durability test was performed thereon at 90℃, for 500 hours, optical properties were deteriorated, besides the compensation film became curled extremely, thus the compensation film could not be put into practical use.

[0041]

The optical compensation films obtained according to EXAMPLE 2 and COMPARATIVE EXAMPLE were laminated on a TN liquid crystal cell through a 25 μm-thick acrylic adhesive layer, and

when a durable test was performed thereon at 90℃, for 240 hours, as a result, although in the optical compensation film according to EXAMPLE 2, any changes in display state by lighting were not recognized, in COMPARATIVE EXAMPLE, however frame-shaped unevenness due to optical distortion was observed.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view showing an embodiment of an optical compensation film according to the present invention;

Fig. 2 is a sectional view showing other embodiment of an optical compensation film according to the present invention; and

Fig. 3 is a sectional view of still other embodiment of an optical compensation film according to the present invention.

SYMBOL

1: support film

2: phase difference layer

3: polarizing layer

4: protective layer